UNIVERSIDADE DA CORUÑA

<table>
<tr><td colspan="6" align="center">Teaching Guide</td></tr>
<tr><td colspan="4" align="center">Identifying Data</td><td colspan="2" align="center">2023/24</td></tr>
<tr><td>Subject (*)</td><td colspan="3">Fundamentals of Image Processing and Analysis</td><td>Code</td><td>614535001</td></tr>
<tr><td>Study programme</td><td colspan="5">Máster Universitario en Visión por Computador</td></tr>
<tr><td colspan="6" align="center">Descriptors</td></tr>
<tr><td align="center">Cycle</td><td align="center">Period</td><td align="center">Year</td><td align="center">Type</td><td colspan="2" align="center">Credits</td></tr>
<tr><td>Official Master's Degree</td><td>1st four-month period</td><td>First</td><td>Obligatory</td><td colspan="2">6</td></tr>
<tr><td>Language</td><td colspan="5">English</td></tr>
<tr><td>Teaching method</td><td colspan="5">Hybrid</td></tr>
<tr><td>Prerequisites</td><td colspan="5"></td></tr>
<tr><td>Department</td><td colspan="5">Ciencias da Computación e Tecnoloxías da Información</td></tr>
<tr><td>Coordinador</td><td colspan="2">Barreira Rodriguez, Noelia</td><td>E-mail</td><td colspan="2">noelia.barreira@udc.es</td></tr>
<tr><td rowspan="2">Lecturers</td><td colspan="2">Barreira Rodriguez, Noelia</td><td>E-mail</td><td colspan="2">noelia.barreira@udc.es</td></tr>
<tr><td colspan="2">Ramos García, Lucia</td><td></td><td colspan="2">l.ramos@udc.es</td></tr>
<tr><td>Web</td><td colspan="5"></td></tr>
<tr><td>General description</td><td colspan="5">This curricular unit addresses the most fundamental topics in image processing and analysis and presents itself as the first in a sequence with another curricular unit where the advanced topics are presented. In addition to the study and application of fundamental techniques of image processing and analysis, applications in this area are studied that aim to solve real problems. This approach gives students the necessary tools to apply the algorithms studied in practical cases, as well as the basis for developing new algorithms and pursue the study for more advanced methods.</td></tr>
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<tr><td colspan="2" align="center">Study programme competences</td></tr>
<tr><td align="center">Code</td><td align="center">Study programme competences</td></tr>
<tr><td>A1</td><td>CE1 - To know and apply the concepts, methodologies and technologies of image processing</td></tr>
<tr><td>A3</td><td>CE3 - To know and apply the concepts, methodologies and technologies of image and video analysis</td></tr>
<tr><td>B7</td><td>CG2 - Ability to analyze a company's needs in the field of computer vision and determine the best technological solution for it</td></tr>
<tr><td>B9</td><td>CG4 - Ability to critically analyze and rigorously evaluate technologies and methodology</td></tr>
<tr><td>B10</td><td>CG5 - Ability to identify unsolved problems and provide innovative solutions</td></tr>
<tr><td>B12</td><td>CG7 - Ability to learn autonomously for specialization in one or more fields of study</td></tr>
<tr><td>C1</td><td>CT1 - Practice the profession with a clear awareness of its human, economic, legal and ethical dimensions and with a clear commitment to quality and continuous improvement</td></tr>
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<tr><td colspan="4" align="center">Learning outcomes</td></tr>
<tr><td align="center">Learning outcomes</td><td colspan="3" align="center">Study programme competences</td></tr>
<tr><td>Understand the basic concepts and techniques of digital image processing.</td><td>AC1</td><td>BC12</td><td></td></tr>
<tr><td>Understand the basic concepts and techniques of digital image analysis.</td><td>AC3</td><td>BC12</td><td></td></tr>
<tr><td>Ability to apply different basic techniques for computer vision problems.</td><td></td><td>BC7
BC10</td><td>CC1</td></tr>
<tr><td>Know how to assess the adequacy of the methodologies applied in specific problems.</td><td></td><td>BC9</td><td></td></tr>
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<table>
<tr><td colspan="2" align="center">Contents</td></tr>
<tr><td align="center">Topic</td><td align="center">Sub-topic</td></tr>
<tr><td>Digital image fundamentals</td><td></td></tr>
<tr><td>Human perception and color</td><td></td></tr>
<tr><td>Preprocessing: normalization and enhancement</td><td></td></tr>
<tr><td>Image denoising</td><td></td></tr>
<tr><td>Edge detection</td><td></td></tr>
<tr><td>Image transformations</td><td></td></tr>
<tr><td>Morphological operators</td><td></td></tr>
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Template matching	
Extraction of global features	
Extraction of scale-invariant features	
Hough transform	
Image thresholding	
Region growing and split-and-merge	
Other segmentation techniques	

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Objective test	A1 A3 B10	3	0	3
Laboratory practice	A1 A3 B10	15	44	59
Research (Research project)	A1 A3 B7 B9 B10 B12 C1	10	40	50
Guest lecture / keynote speech	A1 A3 C1	14	24	38
Personalized attention		0		0
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Objective test	Test with questions about the theoretical contents of the subject as well as practical problems.
Laboratory practice	Analysis and resolution of practical cases using techniques learned in lectures.
Research (Research project)	Proposal of two assignments in image analysis that require to identify the problem, to formulate it precisely, to develop suitable procedures, to interpret the results and to extract appropriate conclusions about the work.
Guest lecture / keynote speech	Oral presentation using audiovisual material and student interaction designed to transmit knowledge and encourage learning.

Personalized attention	
Methodologies	Description
Research (Research project) Laboratory practice	Teachers will answer the doubts during the laboratory practice and they will provide personal advising for the supervised projects.

Assessment			
Methodologies	Competencies	Description	Qualification
Research (Research project)	A1 A3 B7 B9 B10 B12 C1	Two assignments that consist of the development of image processing and computer vision applications. It will be assessed the suitability of the proposed solutions and the quality of the obtained results.	60
Objective test	A1 A3 B10	Written test with theoretical questions and practical problems to be solved.	40
Laboratory practice	A1 A3 B10	Practical exercises about the topics learned in the lectures. It will be assessed the suitability of the proposed solutions and the quality of the obtained results.	0

Assessment comments
The objective test is 40% of the final grade. However, students can achieve this percentage of the final grade with the laboratory exercises during the year. This way, if the laboratory exercises are presented, the exam is optional.
If a student presents the laboratory exercises and attends the objective test, the grade obtained in the objective test will prevail over the grade achieved in the laboratory exercises.

Sources of information

Basic	- David A. Forsyth, Jean Ponce (2003). Computer vision. Prentice - Hall
	- Rafael González, Richard Woods (2008). Digital Image Processing. Pearson
	- Carsten Steger, Markus Ulrich, Christian Wiedemann (2018). Machine Vision Algorithms and Applications. Wiley
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Image Description and Modeling/614535004
Subjects that continue the syllabus
Advanced Image Processing and Analysis/614535002
Other comments

- David A. Forsyth, Jean Ponce (2003). Computer vision. Prentice - Hall
- Rafael González, Richard Woods (2008). Digital Image Processing. Pearson
- Carsten Steger, Markus Ulrich, Christian Wiedemann (2018). Machine Vision Algorithms and Applications. Wiley